

**GAME CONTROLLER SUPPORT STRUCTURE AND ISOMETRIC EXERCISE  
SYSTEM AND METHOD OF FACILITATING USER EXERCISE DURING  
GAME INTERACTION**

**CROSS-REFERENCE TO RELATED APPLICATIONS**

This application is a Continuation-in-Part of copending U.S. Patent Application Serial No. 10/309,565, entitled "Computer Interactive Isometric Exercise System and Method for Operatively Interconnecting the Exercise System to a Computer System for Use as a Peripheral" and filed December 4, 2002. In addition, this application claims priority from U.S. Provisional Patent Application Serial No. 60/514,897, entitled "Configurable Game Controller and Method of Selectively Assigning Game Functions to Controller Input Devices" and filed October 29, 2003. The disclosures of the aforementioned patent applications are incorporated herein by reference in their entirety.

**BACKGROUND OF THE INVENTION**

**1. Technical Field**

The present invention pertains to support structures for video or other game controllers. In particular, the present invention pertains to a support structure for a game controller that requires a user to stand in order to operate the controller and participate in a video or other game. Further, the game controller structure may be in the form of an isometric exercise system that enables the user to perform isometric exercises to interact with the game.

**2. Discussion of the Related Art**

Generally, the operation of video and computer games is performed by users in a sitting or reclining position (e.g., on a couch, chair, floor, etc.). Accordingly, the use of video games tends to decrease the amount of exercise being performed by users. This lack of sufficient exercise may contribute to a growing population of overweight people or even an epidemic of obesity.

In order to enhance the exercise performed by users during a game, the present invention positions the game controller at a sufficient height to require game play by a user be performed in a standing position. In other words, the present invention prevents game play by users in a sitting or reclining position. The standing position enables the

1 user to consume considerably more calories during game play since the large muscles of  
2 the user legs are being utilized. In addition, the present invention may be in the form of an  
3 isometric exercise system enabling a user to perform isometric exercises to interact with  
4 the game, thereby facilitating exercise and consumption of an increased quantity of  
5 calories during game play.

#### 6 OBJECTS AND SUMMARY OF THE INVENTION

7 Accordingly, it is an object of the present invention to require a user to stand  
8 and/or exercise during usage of video or other games to enhance user exercise during  
9 game play.

10 It is another object of the present invention to support a game controller in a  
11 position requiring a user to operate the game controller in a standing position and/or to  
12 exercise to interact with the game to enhance consumption of calories during game play.

13 Yet another object of the present invention is to employ an isometric exercise  
14 system in the form of a game controller to require a user to perform isometric exercises to  
15 interact with the game.

16 The aforesaid objects are achieved individually and/or in combination, and it is not  
17 intended that the present invention be construed as requiring two or more of the objects to  
18 be combined unless expressly required by the claims attached hereto.

19 According to the present invention, a game controller support structure is  
20 configured to require a user to operate a game controller in a standing position during  
21 game play. The support structure includes a frame with a base, a body support, a game  
22 controller and a stand. The stand is attached to the base and supports the game controller,  
23 while the base is sufficiently wide to maintain the stand and controller in a generally  
24 upright position. The stand includes a height sufficient to enable a user (e.g., generally  
25 having a height of five to six feet) to comfortably use the controller in a standing position,  
26 where a user lower body is engaged by the body support. However, the stand and body  
27 support may be adjustable to accommodate a greater range of user heights. The stand may  
28 further be incorporated into other devices or frames that accommodate the user during  
29 game play (e.g., keyboard holders, body braces, cup holders, etc.). The game controller  
30 may be in the form of a custom controller and be integrated into the top of the stand or,  
31 alternatively, the game controller may be a conventional or "off the shelf" controller and  
32 be clamped or otherwise secured to the stand. In addition, the support structure may be in

1 the form of an isometric exercise system that enables a user to perform isometric exercises  
2 during game play to interact with the game.

3 The above and still further objects, features and advantages of the present  
4 invention will become apparent upon consideration of the following detailed description of  
5 specific embodiments thereof, particularly when taken in conjunction with the  
6 accompanying drawings, wherein like reference numerals in the various figures are  
7 utilized to designate like components.

#### 8 BRIEF DESCRIPTION OF THE DRAWINGS

9 Fig. 1 is a diagrammatic illustration of an exemplary gaming system employing the  
10 game controller support structure and exercise system of the present invention.

11 Fig. 2 is a view in perspective of a game controller support structure according to  
12 the present invention.

13 Fig. 3 is a block diagram of a game controller for use with the game controller  
14 support structure of Fig. 2.

15 Fig. 4A is a view in perspective of an alternative configuration for the structure of  
16 Fig. 2 to adjust the stand and/or body support height according to the present invention.

17 Fig. 4B is a view in perspective of another configuration for the structure of Fig. 2  
18 including a pivot mechanism to adjust the controller and/or support member position to  
19 accommodate a user according to the present invention.

20 Fig. 4C is view in perspective of the stand of the structure of Fig. 2 utilized to  
21 support the game controller from a supporting surface according to the present invention.

22 Fig. 5 is a view in perspective of a game controller support structure in the form of  
23 an isometric exercise device according to the present invention.

24 Fig. 6 is a schematic block diagram of an exemplary control circuit for the  
25 isometric exercise device of Fig. 5.

#### 26 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

27 A gaming or entertainment system employing a game controller support structure  
28 according to the present invention is illustrated in Fig. 1. Specifically, gaming system 10  
29 includes one or more controllers 120, 190, a game processor 14 and a monitor or display  
30 16. A controller 120 may be mounted within a corresponding support structure 100, while  
31 a controller 190 may be mounted within a corresponding support structure in the form of  
32 an isometric exercise system 170 as described below. The game processor includes a  
33 storage drive and/or unit to receive computer readable media (e.g., CD, DVD, etc.)

1 containing software for various games and a processing device to execute the software to  
2 provide games on monitor 16. The game processor may be implemented by any  
3 conventional or other processor (e.g., microprocessor, personal computer, video gaming  
4 processor, etc.). For example, the game processor may be implemented by conventional  
5 video games, such as PS2 available from Sony, XBOX available from Microsoft or  
6 GAMECUBE available from Nintendo. The monitor is typically implemented by a  
7 conventional television or other display. The games generally include characters or  
8 objects that are controlled by a user via controllers 120, 190 and/or performance of  
9 exercises. By way of example only, the user may control movement and actions of a  
10 character or a vehicle (e.g., car, airplane, boat, etc.) to move through a virtual environment  
11 displayed on monitor 16. The controllers include a plurality of input devices (e.g.,  
12 joystick, buttons, etc.) to enable a user to interact with the game. The game processor  
13 receives signals from the controllers and updates the display to reflect the movements  
14 and/or actions of the character or object as indicated by user manipulation of the controller  
15 and/or user exercise.

16 The operation of video and computer games is generally performed by users in a  
17 sitting or reclining position (e.g., on a couch, chair, floor, etc.), thereby decreasing or  
18 minimizing the amount of exercise being performed by users. In order to enhance the  
19 exercise performed by users during a game, the present invention support structure  
20 positions the game controller at a sufficient height to require that game play by a user be  
21 performed in a standing position. A game controller support structure according to the  
22 present invention that requires operation of the controller by a user in a standing position  
23 is illustrated in Fig. 2. Specifically, structure 100 includes a frame 90 with a base 92  
24 including a pair of elongated base mounting members 101 and a pair of elongated base  
25 stability members 102. The base mounting and stability members are each preferably  
26 implemented by substantially cylindrical posts or rods. The base mounting members are  
27 spaced apart by a slight distance and basically extend along the structure longitudinal axis  
28 substantially in parallel. The base stability members are each attached at a corresponding  
29 end of the base mounting members via brackets or clamps 109 and extend transversely  
30 therefrom to form an "I" configuration for the base.

31 The base stability members engage a support surface (e.g., floor, etc.) to stabilize  
32 the structure frame and include a slight curved configuration to suspend the base mounting  
33 members slightly above that surface. The base stability member at the front of the

1 structure may include grips 105 disposed at each end and extending rearward therefrom to  
2 provide a gripping surface for user feet. The grips are each generally rectangular and  
3 include a series of slots 115 defined therein to enhance gripping between the gripping  
4 surface and user feet. The front and/or rear stability members may include feet 112 each  
5 disposed toward a corresponding stability member end to engage the support surface. The  
6 structure feet enhance gripping and/or maintain the support structure in a substantially  
7 level orientation. Feet 112 may be of any quantity, shape or size, may be disposed at any  
8 suitable locations and may be constructed of any suitable gripping materials (e.g., rubber,  
9 plastic, etc.). Alternatively, the structure may include a gripping platform (not shown)  
10 constructed of a suitable gripping material (e.g., rubber, plastic, etc.) for engagement by  
11 user feet. The gripping platform may include a single sufficiently sized platform or a  
12 plurality of segments or planks of any shape or size and arranged in any fashion to  
13 accommodate the structure and user feet. In this case, feet 112 may facilitate mounting of  
14 the structure to the gripping platform and maintain the structure in a substantially level  
15 orientation.

16 Body support 103 is configured to support a user lower body portion (e.g.,  
17 buttocks, etc.) and is secured to a rear portion of the base mounting members via a bracket  
18 or clamp 108. Body support 103 includes a substantially upright post 104 and a support  
19 member 106. The post and support member are preferably in the form of substantially  
20 cylindrical rods with the support member being attached to the top of the upright post and  
21 extending transversely therefrom to form a "T" type configuration. The support member  
22 includes a curved configuration to contour a user body portion and generally cylindrical  
23 pads 107 extending inward from each support member end to enhance user comfort. The  
24 user lower portion (e.g., buttocks, etc.) is basically placed within the support member  
25 interior and against pads 107 during game play to support the user in a standing position.

26 Frame 90 further includes a stand or post 110 for supporting controller 120. In  
27 particular, stand 110 is attached, via a bracket or clamp 111, to base mounting members  
28 101 proximate front base stability member 102. The stand is substantially upright and  
29 preferably modular and is constructed of a suitably rigid material (e.g., plastic, a metal,  
30 etc.). While the stand is generally cylindrical, it is noted that the stand may be of any  
31 suitable shape (e.g., bent or curved, V-shaped, etc.) and have any suitable exterior surface  
32 geometries (e.g., curved, multifaceted, etc.).

33 Controller 120 is attached or secured to the stand upper portion. The controller is

1 coupled to game processor 14 (Fig. 1) via cables (not shown) that may extend from the  
2 controller externally of or internally through stand 110. The controller may be of the type  
3 available for conventional video games (e.g., PS2 available from Sony, XBOX available  
4 from Microsoft, GAMECUBE available from Nintendo, etc.), such as the device described  
5 in U.S. Patent No. 6,231,444, the disclosure of which is incorporated herein by reference  
6 in its entirety. In this case, the controller may be secured to the stand upper portion via  
7 conventional or other fastening devices (e.g., clamps, brackets, etc.). Alternatively, the  
8 controller may be custom manufactured and formed integral with stand 110.

9 Controller 120 preferably includes a series of buttons 123 and one or more  
10 joysticks 121 to interact with the game. Further, the controller generally includes  
11 respective signal sources (e.g., variable resistors or potentiometers, switches, etc.) to  
12 provide signals indicating button actuation and joystick motion along X (e.g., left/right  
13 motions) and Y (e.g., forward/back motions) axes as described below. However, the  
14 controller may include any quantity of any type of input devices (e.g., buttons, switches, a  
15 keypad, joystick, etc.) and signal sources disposed at any location and arranged in any  
16 fashion on the controller, where the buttons and joystick may be utilized to enter any  
17 desired information (e.g., enter desired user actions for the game, etc.).

18 Referring to Fig. 3, controller 120 generally includes input devices 20 and signal  
19 sources 22 each associated with an input device. Input devices 20 are each manipulable  
20 by a user to enter information or perform some action within a game. These devices  
21 include buttons 123 and joysticks 121 (Fig. 2), and may be in the form of any conventional  
22 or other controller input devices (e.g., buttons, switches, joysticks, etc.). The input  
23 devices are each coupled to one or more corresponding signal sources 22. The signal  
24 sources each basically detect or measure manipulation of a corresponding input device and  
25 produce a signal indicating the measurement or detection. The signal sources may be  
26 implemented by any conventional or other components (e.g., switch, contact, variable  
27 resistor or potentiometer, etc.). By way of example only, a controller input device in the  
28 form of a button may be associated with a signal source in the form of a contact or switch  
29 that closes a circuit in response to button actuation, thereby producing a signal indicating  
30 that condition. Further, a controller input device in the form of a joystick may have each  
31 particular axis of motion be associated with a respective signal source in the form of a  
32 variable resistor or potentiometer whose resistance varies in accordance with joystick  
33 motion along that axis. The signal source produces a signal indicating a measurement of

1 joystick motion along the corresponding axis.

2 The signals produced by signal sources 22 are processed by a signal processor 28.  
3 The signal processor may be in the form of game processor 14 (Fig. 1) or a conventional  
4 or other processor that may be disposed within controller 120. The signal processor  
5 arranges the signal information into a format compatible with game processor 14. The  
6 inputs of signal processor 28 are coupled in a fixed manner to specific controller signal  
7 sources. Thus, the signal processor or game processor knows the controller input device  
8 associated with each input and maps game functions to those inputs (or controller input  
9 devices) in accordance with the assignments within the game software.

10 Referring back to Fig. 2, stand 110 and body support 103 of structure 100 may be  
11 of fixed dimensions or may be adjustable to accommodate various user heights and body  
12 portions. Specifically, stand 110 and body support 103 may each include a substantially  
13 cylindrical upper rod 117 and a substantially cylindrical lower rod 119. The dimensions of  
14 lower rod 119 are greater than those of upper rod 117 to permit the upper rod to be  
15 partially inserted into the lower rod in a sliding or telescoping arrangement. A clamp 131  
16 is disposed about the lower rod upper portion. The clamp includes a tension member 133  
17 that serves to increase or decrease the pressure applied by the clamp to the lower rod. The  
18 tension member is preferably in the form of a lever, but may be any conventional or other  
19 securing or tension devices (e.g., screw, nut, bolt, lever, etc.). Once the upper rod is  
20 adjusted relative to the lower rod to place the corresponding controller or support member  
21 at a desired position, the tension member is manipulated to tighten the clamp. The clamp  
22 basically applies pressure to the lower rod walls to frictionally engage the walls of upper  
23 rod 117 inserted within the lower rod. The frictional engagement prevents the upper rod  
24 from sliding relative to the lower rod, thereby effectively locking the upper rod (and  
25 corresponding game controller or support member) at a desired height or position. The  
26 tension member may be manipulated to loosen the clamp, thereby enabling the upper rod  
27 position to be altered as described above. The clamp and tension member may be  
28 implemented by any conventional or other clamp or pressure application devices.

29 An alternative embodiment of an adjustable stand 110 and body support 103 is  
30 illustrated in Fig. 4A. Specifically, stand 110 and body support 103 may each include  
31 substantially cylindrical upper rod 117 and substantially cylindrical lower rod 119 as  
32 described above. The dimensions of lower rod 119 are greater than those of upper rod 117  
33 to permit the upper rod to be partially inserted into the lower rod in a sliding or telescoping

1 arrangement as described above. The upper and lower rods each include a series of  
2 openings 141. The openings are disposed toward a lower portion of the upper rod and  
3 toward an upper portion of the lower rod, thereby enabling alignment or overlap of the  
4 openings during adjustment of the corresponding controller or support member height.  
5 The openings include dimensions slightly greater than those of a pin 143 to receive the pin  
6 and adjust the height of the corresponding stand or body support. In particular, the upper  
7 rod is inserted into the lower rod until the corresponding controller or support member is  
8 at a desired height and at least one opening of each rod is aligned. Pin 143 is substantially  
9 cylindrical and is inserted into the appropriate aligned openings to secure the rods in the  
10 desired configuration and place the corresponding controller or support member at the  
11 desired height. The pin may be removed from the openings to enable the corresponding  
12 controller or support member position to be altered as described above. The openings may  
13 be of any quantity, shape or size and may be arranged in any fashion on the rods to adjust  
14 the height of the corresponding stand or body support.

15 The stand and body support may further include pivoting mechanisms to enable  
16 adjustment of controller or support member position as illustrated, by way of example  
17 only, in Fig 4B. Specifically, stand 110 and body support 103 may each include  
18 substantially cylindrical upper rod 117 and substantially cylindrical lower rod 119, each  
19 substantially similar to those described above. The lower and upper rods may be fixed  
20 relative to each other, or may be configured in the manners described above to facilitate  
21 adjustment of height. Controller 120 and support member 106 may each be secured to a  
22 corresponding arm 127. The arm is preferably substantially cylindrical, but may be of any  
23 shape, and is coupled to a corresponding upper rod 117 via a pivot mechanism 125  
24 disposed at the upper portion of the upper rod. The pivot mechanism may be implemented  
25 by any conventional or other mechanisms (e.g., bearings, hinges, ratchets, gears, gimbal,  
26 etc.) enabling arm 127 to be manipulated relative to upper rod 117. For example, the pivot  
27 mechanism may enable arm 127 to be moved longitudinally and/or transversely (e.g.,  
28 moved in any desired angular motion) relative to the upper rod. The stand and/or body  
29 support may be manipulated to respectively place the controller and/or support member at  
30 a desired height and at a desired position or orientation relative to a user for game play.  
31 Further, the pivot mechanism may include any conventional or other stop or lock  
32 mechanism to maintain the corresponding controller or support member at the desired  
33 position and/or orientation.



1 In addition, the stand and body support may each include an additional pivot  
2 mechanism 129. This mechanism is substantially similar to pivot mechanism 127  
3 described above and is disposed toward a corresponding arm distal end to enable the  
4 corresponding controller or support member to be manipulated relative to the arm. For  
5 example, mechanism 129 may enable the corresponding controller or support member to  
6 be moved longitudinally or transversely (e.g., moved in any desired angular motion)  
7 relative to the arm. The controller or support member may be manipulated to any desired  
8 position or orientation relative to a user for game play. Further, the pivot mechanism may  
9 include any conventional or other stop or lock mechanism to maintain the corresponding  
10 controller or support member in the desired position and/or orientation.

11 The stands described above may be used with various devices or frames (e.g.,  
12 keyboard holders, body braces, cup holders, etc.) to support the game controller. Further,  
13 the stands may be attached to any supporting surfaces as illustrated in Fig. 4C.  
14 Specifically, stand 110 may be attached or secured to a supporting surface 135 (e.g., in the  
15 form of a wall, ceiling, door, furniture, etc.). The stand is secured in a manner to place the  
16 controller at a height requiring a user to operate the controller in a standing position as  
17 described above. The stand may include any of the adjustment configurations described  
18 above and may be manipulated to place the controller at any desired height, position  
19 and/or orientation relative to a user for game play.

20 Operation of the game controller support structure is described with reference to  
21 Figs. 1 – 3. Initially, a user couples the controller to game processor 14. A game is  
22 selected and executed on the game processor, and the user mounts structure 100 by placing  
23 user feet on grips 105 (or the gripping platform) and a user lower body portion (e.g.,  
24 buttocks, etc.) against support member 106 as described above. The structure places the  
25 controller at a desired height to require the user to stand during game play. The structure  
26 may further include an adjustable configuration, where the controller and/or support  
27 member may be manipulated to desired positions as described above. Once the user is  
28 situated on the structure, the controller is manipulated by the user in a standing position to  
29 interact with the game.

30 The game controller support structure may be in the form of an isometric exercise  
31 device or system enabling a user to perform isometric exercises to interact with the game,  
32 thereby facilitating exercise and consumption of an increased quantity of calories during  
33 game play. A game controller support structure in the form of an isometric exercise

1 device or system is illustrated in Fig. 5. Initially, isometric exercise device or system 170  
2 is substantially similar to game controller support structure 100 described above for Fig. 2  
3 and is of the type disclosed in aforementioned U.S. Patent Application Serial No.  
4 10/309,565. The exercise system basically enables the user to interact with the game in  
5 accordance with exercise performed by the user on the system as described below.

6 Specifically, isometric exercise device or system 170 includes frame 90 with base  
7 92 including elongated base mounting members 101 and elongated base stability members  
8 102, each as described above. The base mounting members are spaced apart by a slight  
9 distance and basically extend along the system longitudinal axis substantially in parallel.  
10 The base stability members are each attached at a corresponding end of the base mounting  
11 members via brackets or clamps 109 and extend transversely therefrom to form an "I"  
12 configuration for the base.

13 The base stability members engage a support surface (as described above for Fig.  
14 2) to stabilize the system frame and include a slight curved configuration to suspend the  
15 base mounting members slightly above that surface as described above. The base stability  
16 member at the front of the system may include grips 105 disposed at each end and  
17 extending rearward therefrom to provide a gripping surface for user feet. The front and/or  
18 rear stability members may include feet 112 to engage the support surface and to maintain  
19 the system in a substantially level orientation as described above. Alternatively, the base  
20 stability members may facilitate mounting of the system to a gripping platform via feet  
21 112 as described above.

22 Body support 103 is configured to support a user lower body portion (e.g.,  
23 buttocks, etc.) and is secured to a rear portion of the base mounting members via bracket  
24 or clamp 108 as described above. Body support 103 includes substantially upright post  
25 104 and support member 106 attached to the top of the upright post and extending  
26 transversely therefrom to form a "T" type configuration as described above. The support  
27 member includes a curved configuration to contour a user body portion and generally  
28 cylindrical pads 107 extending inward from each support member end to enhance user  
29 comfort. The user lower portion (e.g., buttocks, etc.) is basically placed within the support  
30 member interior and against pads 107 during game play to support the user in a standing  
31 position as described above.

32 The frame further includes an effector bar 180 for manipulation by a user. In  
33 particular, effector bar 180 is attached, via bracket or clamp 111, to base mounting

1 members 101 proximate front base stability member 102. The effector bar is substantially  
2 upright and preferably modular and is constructed of a suitably rigid material (e.g., a metal  
3 alloy, etc.) that is capable of being slightly deflected within its elastic limit in response to  
4 any combination of bending, twisting, tension and compression forces applied by the user  
5 to the bar. While the effector bar is generally cylindrical, it is noted that the effector bar  
6 may be of any suitable shape (e.g., bent or curved, V-shaped, etc.) and include any suitable  
7 exterior surface geometries (e.g., curved, multifaceted, etc.). Additional effector bars may  
8 be secured to effector bar 180 to provide various configurations for exercise. Effector bar  
9 180 and body support post 104 may include clamp 131 and tension member 133 or other  
10 configurations similar to those described above (e.g., Figs. 4A – 4B) to adjust the height,  
11 position and/or orientation of the effector bar or support member relative to a user as  
12 described above. Alternatively, extender rods may be employed to configure the effector  
13 bar in accordance with user characteristics (e.g., height, reach, etc.).

14 Controller 190 is attached or secured to the effector bar upper portion. The  
15 controller is similar to controller 120 described above and may be of the type available for  
16 conventional video games (e.g., PS2 available from Sony, XBOX available from  
17 Microsoft, GAMECUBE available from Nintendo, etc.), such as the device described in  
18 aforementioned U.S. Patent No. 6,231,444. The controller preferably includes a series of  
19 buttons 123 and a joystick 121 disposed on the controller upper portion. Basically,  
20 effector bar 180 serves the function of a second controller joystick with respect to a game.  
21 The controller generally includes respective signal sources (e.g., variable resistor or  
22 potentiometers, etc.) to provide signals indicating button actuation and joystick motion  
23 along X (e.g., left/right motions) and Y (e.g., forward/back motions) axes. However, the  
24 controller may include any quantity of any type of input devices (e.g., buttons, switches, a  
25 keypad, joystick, etc.) and signal sources disposed at any location and arranged in any  
26 fashion on the controller. The buttons and joystick may be utilized to enter any desired  
27 information (e.g., enter desired user actions for the game, etc.). Further, the controller may  
28 include input devices 156 (Fig. 6) to enter and reset resistance controls and reset clock or  
29 other functions as described below. Device 156 may be implemented by any conventional  
30 or other input devices (e.g., buttons, slides, switches, etc.). The controller lower portion  
31 includes a generally “U”-shaped handle or grip 122 for engagement by a user, where the  
32 grip lower surface is generally attached to the top surface of effector bar 180. However,  
33 the controller may be attached or secured to the effector bar in any desired fashion.

Effector bar 180 includes at least one sensor to measure at least one type of strain applied by the user to that bar. Preferably, effector bar 180 includes strain gauge sensors 150, 160 that are arranged at suitable locations on the bar near the controller. These sensors measure the amount of a strain deformation applied to the bar as a result of the user applying pushing, pulling or lateral forces to the controller handle. By way of example only, sensor 150 may measure force applied to the effector bar along an X-axis (e.g., lateral or left/right forces), while sensor 160 may measure forces applied to the effector bar along a Y-axis (e.g., push/pull or forward/backward forces). Additional effector bars may each include respective strain gauge sensors to measure the amounts of bending strain applied to those bars.

The sensors are connected to or within a control circuit 200 (Fig. 6) disposed within controller 190, where the controller provides appropriate information to game processor 14. Strain gauge measurements that are received by game processor 14 are processed to display a virtual reality scenario on display 16. The scenario is updated in accordance with strain forces applied to the effector bar by a user. The controller may further be configured to control the level of exertion required by a user for one or more effectors in order to achieve a particular response in the virtual reality scenario. Resistance levels may be input to an exercise processor by the user via input device 156 (e.g., a keypad). Alternatively, or in combination with user input, the resistance levels may be controlled by the exercise processor based upon conditions within the virtual reality scenario, such as changing wind conditions, changing grade of the terrain (e.g., going uphill), etc.

A display 124 is further disposed on the controller upper portion and may display various information to the user (e.g., the degree of force applied to a particular effector bar at any given time, the amount of work performed by the user during a particular exercise session, resistance levels, time or elapsed time, force applied to the various axes (X and Y axes), instantaneous force applied and/or any other exercise or other related information). The display is preferably implemented by a Liquid Crystal Display (LCD), but may be any type of display (e.g., LED, etc.).

An exemplary control circuit for the system is illustrated in Fig. 6. Specifically, control circuitry 200 includes sensors 150, 160 and corresponding amplifiers 152, 162, an exercise processor 154 and a signal processor 164. A conventional power supply (not shown) provides appropriate power signals to each of the circuit components. The circuit

1 may be powered by a battery and/or any other suitable power source. A power switch (not  
2 shown) may further be included to activate the circuit components.

3 Sensors 150, 160 are each connected to a respective amplifier 152, 162. The  
4 electrical resistance of sensors 150, 160 vary in response to compression and stretching of  
5 the effector bar. Amplifiers 152, 162 basically amplify the sensor signals (e.g., in a range  
6 compatible with the type of controller employed). The amplified voltage value is sent by  
7 each amplifier to exercise processor 154. Exercise processor 154 may be implemented by  
8 any conventional or other processor and typically includes circuitry and/or converts the  
9 analog signals from the amplifiers to digital values for processing. Basically, the amplified  
10 sensor value represents the force applied by the user, where values toward the controller  
11 range maximum indicate greater applied force. The amplified analog value is digitized or  
12 quantized within a range in accordance with the quantity of bits within the converted  
13 digital value (e.g., -127 to +127 for eight bits signed, -32,767 to +32,767 for sixteen bits  
14 signed, etc.) to indicate the magnitude and/or direction of the applied force. Thus,  
15 amplified voltage values toward the controller range maximum produce digital values  
16 toward the maximum values of the quantization ranges.

17 The exercise processor receives resistance level and reset controls from the user  
18 via input device 156 as described above, and controls amplifier gain parameters to adjust  
19 system resistance in accordance with the user specified controls. In particular, the exercise  
20 processor adjusts the gain control of the amplifiers in order to facilitate a resistance level  
21 in accordance with user input and/or the virtual reality scenario. The gain control  
22 parameter basically controls the amount of gain applied by the amplifier to an amplifier  
23 input (or sensor measurement). Since greater amplified values correspond to a greater  
24 force, increasing the amplifier gain enables a user to exert less force to achieve a particular  
25 amplified force value, thereby effectively lowering the resistance of the system for the  
26 user. Conversely, reducing the amplifier gain requires a user to exert greater force to  
27 achieve the particular amplified force value, thereby increasing the resistance of the  
28 system for the user. The exercise processor further adjusts an amplifier Auto Null  
29 parameter to zero or tare the strain gauge sensors.

30 The exercise processor is further connected to display 124 to facilitate display of  
31 certain exercise or other related information as described above. The exercise processor  
32 receives the amplified sensor values and determines various information for display to a  
33 user (e.g., the degree of force applied to a particular effector bar at any given time, the

1 amount of work performed by the user during a particular exercise session, resistance  
2 levels, time or elapsed time, force applied to the various axes (X and Y axes),  
3 instantaneous force applied and/or any other exercise or other related information). In  
4 addition, the exercise processor resets various parameters (e.g., resistance, time, work,  
5 etc.) in accordance with reset controls received from input device 156.

6         Signal processor 164 receives the signals from amplifiers 152, 162, and the signal  
7 sources for joystick 121 and buttons 123. The signal processor inputs are typically mapped  
8 to game functions in accordance with the game software executed by game processor 14.  
9 The signal processor may be implemented by any conventional or other processor and  
10 typically includes circuitry and/or converts the analog signals from the amplifiers and/or  
11 signal sources for the joystick and/or buttons to digital values for processing in  
12 substantially the same manner described above. The signal processor samples memory  
13 locations receiving the inputs at predetermined time intervals (e.g., preferably on the order  
14 of ten milliseconds or less) to continuously process and send information to the game  
15 processor to update and/or respond to an executing gaming application.

16         Basically, the signal processor processes and arranges the input signals into  
17 suitable data packets for transmission to the game processor. The signal processor may  
18 process raw digital values in any fashion to account for various calibrations or to properly  
19 adjust the values within quantization ranges. The data packets are in a format resembling  
20 data input from a standard peripheral device (e.g., game controller, etc.). For example, the  
21 processor may construct a data packet that includes the status of all controller input  
22 devices (e.g., joystick 121, buttons 123, etc.) and the values of each sensor. By way of  
23 example only, the data packet may include header information, X-axis information  
24 indicating a corresponding sensor force and joystick measurement along this axis, Y-axis  
25 information indicating a corresponding sensor force and joystick measurement along this  
26 axis, rudder or steering information, throttle or rate information and additional information  
27 relating to the status of input devices (e.g., buttons, etc.). Additional packet locations may  
28 be associated with data received from controller or other input devices connected with the  
29 signal processor, where the input devices represent additional operational criteria for the  
30 scenario (e.g., the firing of a weapon in the scenario when the user presses an input button,  
31 throttle, etc.). The game processor processes the information or data packets in  
32 substantially the same manner as that for information received from a conventional  
33 peripheral (e.g., game controller, etc.) to update and/or respond to an executing gaming

1 application (e.g., game, etc.).

2 Operation of system 170 is described with reference to Figs. 5 – 6. Initially, the  
3 user couples the system to game processor 14. A game is selected and executed on the  
4 game processor, and the user mounts system 170 to engage in an isometric exercise in  
5 order to interact with the game. The user operates system 170 with the user lower body  
6 portion (e.g., buttocks, etc.) against body support 103, the user feet engaging grips 105 (or  
7 the gripping platform) and the user hands placed on controller handle 122. The user grips  
8 the controller handle and applies a force to the controller to exert a strain on the effector  
9 bar. The user applies one or more forces to the controller and, hence, the effector bar with  
10 respect to at least one of the X and Y axes so as to effect corresponding movement, for  
11 example, of a character or an object in the scenario displayed by the game processor. The  
12 user may further manipulate joystick 121, buttons 123 and/or other controller input  
13 devices for additional actions depending upon the particular game. In addition, the user  
14 may enter desired parameters (e.g., reset, resistance, etc.) via input devices 156 to control  
15 system operation as described above.

16 The signals from the sensors and input devices 156 are provided to exercise  
17 processor 154 to display various information on display 124 and control system operation  
18 as described above. The signals from the sensors and control input devices (e.g., joystick,  
19 buttons, etc.) are provided to signal processor 164 as described above. The signal  
20 processor generates the data packets for transference to game processor 14. The game  
21 processor processes the information or data packets in substantially the same manner as  
22 that for information received from a conventional peripheral (e.g., game controller, etc.) to  
23 update and/or respond to an executing gaming application. Thus, the force applied by the  
24 user to the effector bar results in a corresponding coordinate movement or action in the  
25 scenario displayed on display 16 in accordance with the function assigned to the bar. In  
26 other words, user exercise serves to indicate desired user actions or movements to the  
27 game processor to update movement or actions of characters or objects within the game in  
28 accordance with the function assigned to the bar. For example, when the effector bar  
29 controls accelerator and steering functions, application of a forward force to the controller  
30 may serve as the accelerator, while lateral force applied to the controller may serve as the  
31 steering function.

32 It will be appreciated that the embodiments described above and illustrated in the  
33 drawings represent only a few of the many ways of implementing a game controller

1 support structure and isometric exercise system and method of facilitating user exercise  
2 during game interaction.

3 The controllers may be of any shape or size, may be constructed of any suitable  
4 materials, and may be of the type of any commercially available or other game controller  
5 (e.g., those for use with PS2, XBOX, GAMECUBE, etc.). The controllers may include  
6 any quantity of any types of input devices (e.g., buttons, slides, joysticks, track type balls,  
7 etc.) disposed at any locations and arranged in any fashion. The controllers may include  
8 any quantity of any types of signal source devices to generate signals in accordance with  
9 input device manipulation (e.g., variable resistors or potentiometers, switches, contacts,  
10 relays, sensors, etc.). The signal sources may correspond with any quantity of motion axes  
11 for an input device. The controllers may include any quantity of grips or handles of any  
12 shape or size disposed at any suitable locations. The controllers may include any quantity  
13 of any types of displays (e.g., LED, LCD, etc.) of any shape or size and/or input devices  
14 (e.g., buttons, joysticks, etc.) at any desired locations to display and enter any desired  
15 information.

16 The game processor may be implemented by any quantity of any personal or other  
17 type of computer or processing system (e.g., IBM-compatible, Apple, Macintosh, laptop,  
18 palm pilot, microprocessor, gaming consoles such as the XBOX system from Microsoft  
19 Corporation, the PLAY STATION 2 system from Sony Corporation, the GAMECUBE  
20 system from Nintendo of America, Inc., etc.). The game processor may be a dedicated  
21 processor or a general purpose computer system (e.g., personal computer, etc.) with any  
22 commercially available operating system (e.g., Windows, OS/2, Unix, Linux, etc.) and/or  
23 commercially available and/or custom software (e.g., communications software,  
24 application software, etc.) and any types of input devices (e.g., keyboard, mouse,  
25 microphone, etc.). The game processor may execute software from a recorded medium  
26 (e.g., hard disk, memory device, CD, DVD or other disks, etc.) or from a network or other  
27 connection (e.g., from the Internet or other network).

28 The support structure, exercise system and associated components (e.g., frame,  
29 effector bar, connectors, base, base members, body support, grips, etc.) may be of any size  
30 or shape, may be arranged in any fashion and may be constructed of any suitable  
31 materials. The mounting and stability members may be of any quantity, shape or size,  
32 may be arranged in any fashion and may be constructed of any suitable materials. The  
33 mounting and stability members may be secured to each other at any locations via any



1 conventional or other fastening devices (e.g., brackets, clamps, etc.). The stand and body  
2 support may be of any quantity, shape or size, may be arranged in any fashion and may be  
3 constructed of any suitable materials. The stand and body support may be secured to the  
4 mounting members or at any other frame locations via any conventional or other fastening  
5 devices (e.g., brackets, clamps, etc.). The structure and exercise system may include any  
6 quantity of grips of any shape or size disposed at any suitable locations to accommodate  
7 user feet. Alternatively, the structure and exercise system may be mounted to any type of  
8 gripping surface via any conventional or other mounting techniques (e.g., bolts, fasteners,  
9 lay on surface based on structure or system weight, etc.). The gripping surface may  
10 include a single platform of any size or shape or a plurality of gripping segments or planks  
11 of any size or shape and arranged in any fashion. The grips and gripping surface may be  
12 constructed of any suitable materials (e.g., rubber, plastic, etc.).

13         The support member and post may be of any quantity, shape or size, may be  
14 arranged in any fashion and may be constructed of any suitable materials. The support  
15 member may include any quantity of pads of any shape or size disposed at any suitable  
16 locations. The support member may be configured to accommodate any desired user body  
17 portion. The stand and effector bar may include any conventional or other controllers  
18 (e.g., any of the controllers described above, etc.) for any gaming or other application.  
19 The stand and effector bar may include any suitable dimensions requiring a user to operate  
20 the supported controller in a standing position. The controller may be secured to the stand,  
21 effector bar or frame at any location via any conventional or other securing techniques  
22 (e.g., clamps, brackets, adhesives, etc.). Alternatively, the controller may be formed  
23 integral with the stand, effector bar or frame at any location.

24         The stand, effector bar and body support may include fixed dimensions or include  
25 any desired mechanisms to adjust their height to accommodate a user. The upper and  
26 lower rods may be of any quantity, shape or size and may be constructed of any suitable  
27 materials. The upper and lower rods may include any conventional or other mating  
28 configurations (e.g., telescoping or partial insertion of one rod within the other in any  
29 arrangement (e.g., lower rod within the upper rod, upper rod within the lower rod, etc.),  
30 sliding relation where the rods are placed adjacent in facing relation, etc.) enabling  
31 adjustment of controller or support member height. The openings may be of any quantity,  
32 shape or size and may be disposed at any suitable locations. The pin may be of any  
33 quantity, shape or size and may be constructed of any suitable materials. The clamp may

1 be implemented by any quantity of conventional or other pressure application devices  
2 (e.g., clamp, vice, etc.) and utilize any quantity of any types of conventional or other  
3 tension devices (e.g., lever, screw, bolt, etc.) to adjust pressure applied by the clamp. The  
4 stand, effector bar and body support may include any quantity of any conventional or other  
5 pivoting mechanisms (e.g., hinges, gimbal, ratchet, gears, bracket, etc.) disposed at any  
6 suitable locations to enable manipulation of the controller and support member to any  
7 desired positions and/or orientations relative to a user.

8 The structure and exercise system may be utilized with or without the body  
9 support, while the stand and/or effector bar may alternatively be mounted or secured to  
10 any desired supporting surface (e.g., wall, ceiling, floor, furniture, door, etc.) and/or may  
11 further be mounted to or include any other devices or frames that accommodate the user  
12 during game play (e.g., keyboard holders, body braces, cup holders, etc.).

13 The exercise system effector bar may be constructed of any suitable materials that  
14 preferably are subject to measurable deflection within an elastic limit of the materials  
15 when subjected to one or more straining or other forces by the user. The effector bar may  
16 be of any quantity, shape or size, have any suitable geometric configurations, and two or  
17 more effector bars may be combined in any suitable manner to yield a system frame that  
18 conforms to a desired design for a user for a particular application. Any suitable number  
19 of any types of sensors (e.g., strain gauges, etc.) may be applied to an effector bar to  
20 facilitate the measurement of any one or more types of strain or other forces applied by the  
21 user (e.g., bending forces, twisting forces, compression forces and/or tension forces). The  
22 exercise system may include any quantity of effector bars at any location to receive force  
23 from any desired user body portions (e.g., hands, arms, legs, thighs, abdomen, neck, etc.).

24 Any suitable connector may be utilized to connect any two or more effector bars  
25 together, including, without limitation, lug nuts, couplings, tee fittings, wye fittings and  
26 cross fittings. Any number of connectors may be utilized to form a system frame of  
27 effector bars. The connectors may be constructed of any suitable materials. The frame  
28 may include any quantity of any type of user support disposed at any locations to support a  
29 user or any desired user body portions.

30 Any suitable number of sensors may be utilized to measure any type of strain or  
31 other force applied to any suitable number of effector bars. The sensors may be  
32 constructed of any suitable materials, may be disposed at any effector bar locations and  
33 may be of any suitable type (e.g., strain gauge, etc.). Further, the sensors may include any

1 electrical, mechanical or chemical properties that vary in a measurable manner in  
2 response to applied force to measure force applied to an object. The handle of the exercise  
3 system controller may be of any shape or size and disposed at any location to receive force  
4 applied by a user. Alternatively, the user may apply force directly to the effector bar. The  
5 effector bars may be assigned the gaming functions of any desired controller input  
6 devices.

7 The processors (e.g., exercise, signal, game, etc.) may be implemented by any  
8 quantity of any type of microprocessor, processing system or other circuitry, while the  
9 control circuitry may be disposed at any suitable locations on the frame, within the  
10 controller or, alternatively, remote from the frame. The control circuitry and/or signal  
11 processors may be connected to one or more game processors or host computer systems  
12 via any suitable peripheral, communications media or other port of those systems. The  
13 signal processors may further arrange digital data representing force measurements by  
14 sensors and other controller information into any suitable data packet format that is  
15 recognizable by the game processor or host computer system receiving data packets from  
16 the signal processors. The data packets may be of any desired length, include any desired  
17 information and be arranged in any desired format.

18 The signal processors may sample the information at any desired sampling rate  
19 (e.g., seconds, milliseconds, microseconds, etc.), or receive measurement values or other  
20 information in response to interrupts. The analog values may each be converted to a  
21 digital value having any desired quantity of bits or resolution. The processors (e.g., signal,  
22 exercise, etc.) may process analog or raw digital values in any desired fashion to produce  
23 any desired information for transference to the display, game processor or host computer  
24 system. This information is typically dependent upon a particular application. The  
25 correlation between the measured force and provided value for that force may be  
26 determined in any desired fashion. By way of example only, the amplified measurement  
27 range may be divided into units corresponding to the resolution of the digital value. For  
28 an eight bit unsigned digital value (e.g., where the value indicates the magnitude of force),  
29 each increment represents  $1/256$  of the voltage range. With respect to a five volt range,  
30 each increment is  $5/256$  of a volt, which is approximately 0.02 volts. Thus, for an  
31 amplified force measurement of three volts, the digital value may correspond to  
32 approximately 150 (i.e.,  $3.0/0.2$ ). The exercise processor may determine any desired  
33 information for display to a user (e.g., the degree of force applied to a particular effector

1 bar at any given time, the amount of work performed by the user during a particular  
2 exercise session, resistance levels, time or elapsed time, force applied to the various axes  
3 (X and Y axes), instantaneous force applied and/or any other exercise or other related  
4 information).

5 Any suitable number of any types of conventional or other circuitry may be  
6 utilized to implement the control circuit, amplifiers, sensors and processors (e.g., exercise,  
7 signal, etc.). The amplifiers may produce an amplified value in any desired voltage range,  
8 while the A/D conversion may produce a digitized value having any desired resolution or  
9 quantity of bits (e.g., signed or unsigned). The control circuit may include any quantity of  
10 the above or other components arranged in any fashion. The resistance change of the  
11 sensors may be determined in any manner via any suitable conventional or other circuitry.  
12 The amplifiers and processors (e.g., exercise, signal, etc.) may be separate within a circuit  
13 or integrated as a single unit. Any suitable number of any type of conventional or other  
14 displays may be connected to the processors (e.g., exercise, signal, game, etc.) to provide  
15 any type of information relating to a particular computer interactive isometric exercise  
16 session. A display may be located at any suitable location on or remote from the exercise  
17 system.

18 Any suitable number of additional input devices may be provided for the system to  
19 enhance virtual reality simulation scenarios. The input devices may be provided on any  
20 suitable number of control panels that are accessible by the user during system operation  
21 and have any suitable configuration (e.g., buttons, switches, keypads, etc.). Optionally,  
22 input devices may be provided (e.g., foot pedals, stairs, ski type exercisers, treadmills,  
23 etc.) that provide isokinetic and/or isotonic exercise features in addition to the isometric  
24 exercise features provided by effectors. The additional exercise input devices may further  
25 be resistance controlled by the exercise processor.

26 The resistance level may be controlled by adjusting amplifier or other parameters.  
27 Alternatively, the resistance level may be controlled based on thresholds entered by a user.  
28 For example, the processors (e.g., exercise and/or signal processors) may be configured to  
29 require a threshold resistance level be achieved, which is proportionate to the amount of  
30 straining force applied by the user to one or more effectors, before assigning appropriate  
31 data values to the data packets to be sent to the game processor or host computer.  
32 Threshold values for the change in strain gauge resistance may be input to the processor  
33 by the user via an appropriate input device (e.g., a keypad).

1           It is to be understood that the software of processors (e.g., exercise, game, signal,  
2 etc.) may be implemented in any desired computer language, and could be developed by  
3 one of ordinary skill in the computer and/or programming arts based on the functional  
4 description contained herein. Further, any references herein of software performing  
5 various functions generally refer to computer systems or processors performing those  
6 functions under software control. The processors (e.g., exercise, signal, etc.) may  
7 alternatively be implemented by hardware or other processing circuitry, or may be  
8 implemented on the game processor or host system as software and/or hardware modules  
9 receiving the sensor and/or input device information or signals. The various functions of  
10 the processors (e.g., exercise, signal, game, etc.) may be distributed in any manner among  
11 any quantity (e.g., one or more) of hardware and/or software modules or units, processors,  
12 computer or processing systems or circuitry, where the processors, computer or processing  
13 systems or circuitry may be disposed locally or remotely of each other and communicate  
14 via any suitable communications medium (e.g., LAN, WAN, Intranet, Internet, hardwire,  
15 modem connection, wireless, etc.). The software and/or algorithms described above may  
16 be modified in any manner that accomplishes the functions described herein.

17           The terms “upward”, “downward”, “top”, “bottom”, “side”, “front”, “rear”,  
18 “upper”, “lower”, “vertical”, “horizontal”, “height”, “width”, “length”, “forward”,  
19 “backward”, “left”, “right” and the like are used herein merely to describe points of  
20 reference and do not limit the present invention to any specific orientation or  
21 configuration.

22           The present invention structure and exercise system is not limited to the gaming  
23 applications described above, but may be utilized for any processing system, software or  
24 application.

25           From the foregoing description, it will be appreciated that the invention makes  
26 available a novel game controller support structure and isometric exercise system and  
27 method of facilitating user exercise during game interaction, wherein a game controller  
28 support structure requires a user to operate a controller in a standing position and/or to  
29 exercise to interact with a game.

30           Having described preferred embodiments of a novel game controller support  
31 structure and isometric exercise system and method of facilitating user exercise during  
32 game interaction, it is believed that other modifications, variations and changes will be  
33 suggested to those skilled in the art in view of the teachings set forth herein. It is therefore

- 1 to be understood that all such variations, modifications and changes are believed to fall
- 2 within the scope of the present invention as defined by the appended claims.